

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



AF

(43) International Publication Date
30 September 2004 (30.09.2004)

PCT

(10) International Publication Number
WO 2004/082855 A1

(51) International Patent Classification⁷: **B07C 5/342**,
G01N 21/85, 21/15

(21) International Application Number:
PCT/BE2004/000040

(22) International Filing Date: 18 March 2004 (18.03.2004)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:
2003/0169 18 March 2003 (18.03.2003) BE

(71) Applicant (for all designated States except US): PUL-
SARR INDUSTRIAL RESEARCH B.V. [NL/NL];
Marinus Van Meelweg 20, NL-5657 EN Eindhoven (NL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): RUYMEN, Marc

[BE/BE]; Bierbeekstraat 103, B-3360 Korbeek-Lo (BE).
VAN WANROOLJ, Eric [NL/NL]; Berghemseweg 24,
NL-5388 PT Nistelrode (NL). SMEETS, Eric [NL/NL];
Meidoornstraat 22, NL-6021 AZ Budel (NL).

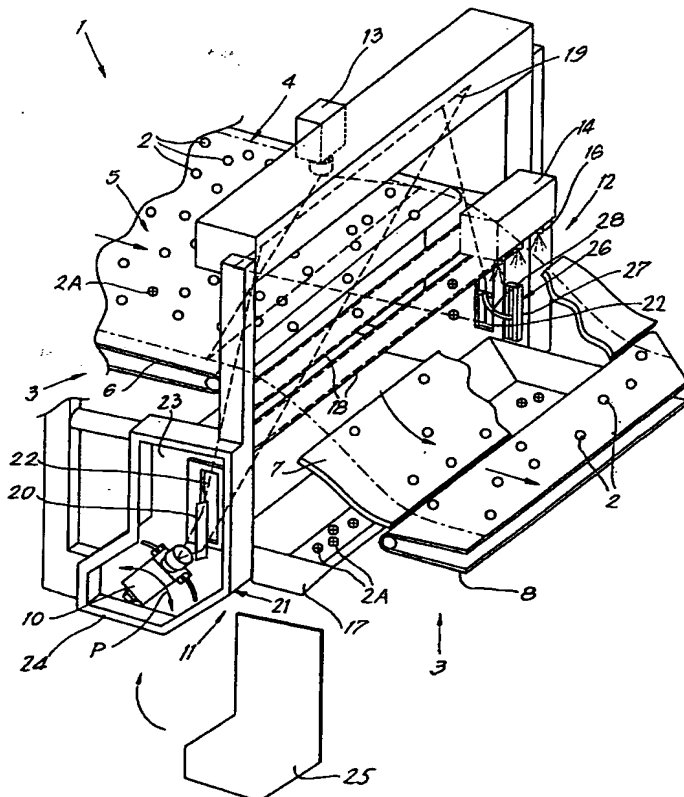
(74) Agents: CALLEWAERT, Koen et al.; Bureau Callewaert
bvba, Brusselsesteenweg 108, B-3090 Overijse (BE).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN,
CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI,
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE,
KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD,
MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG,
PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM,
TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM,
ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,

[Continued on next page]

(54) Title: METHOD AND DEVICE FOR INSPECTING PRODUCTS



(57) Abstract: Device for the inspection of
products, whereby this device (1) comprises
means to convey these products (2) along
a track (4) in the shape of a product flow
(5) extending in the width, characterised in
that it comprises at least one scanner (9-10)
for inspecting the products (2), whereby this
scanner (9-10) is situated on one side of the
aforesaid track (4).

WO 2004/082855 A1

METHOD AND DEVICE FOR INSPECTING PRODUCTS.

The present invention concerns a method and a device for the inspection of products.

5 In particular, it is designed for the automatic detection of undesirable products in a product flow, in order to remove these products automatically, for example.

In particular, it aims a method and a device which are very suitable to be applied in the food industry, for example to sort the products foreign to food out of certain foodstuffs, in particular leaves, sprigs and pieces of waste, such as wood, plastic, stones,
10 etcetera, or also to remove the undesirable food products from foodstuffs, such as for example discoloured, bad, mouldy or damaged food products. Even more specifically, the method and device are designed to be implemented for the inspection and/or sorting of loose food products, such as potatoes, vegetables, nuts, etcetera.

Although the invention is in the first place designed to be implemented in
15 the above-mentioned applications, it is not excluded to use it in other fields and for other applications as well, for example for sorting ores, petrochemical products, etcetera.

It is known that products can be inspected in order to make a possible selection by conveying these products over a specific track in the shape of a product flow extending in the width and by scanning this product flow over the width of the aforesaid track,
20 such that undesired products can be detected. Examples of this technique, whereby the products are inspected by means of a single scanner, are described among others in WO 01/00333 and WO 01/07950.

Devices are also known whereby two scanners are used which are erected in the centre above the product flow and in the centre under the product flow.

25 The devices known until now are disadvantageous in that the scanners are often difficult to access, especially when, in order to scan the products from different sides, use is made of a scanner erected in the centre under the product flow. Especially in the latter case, the above-mentioned scanner and the peripherals used thereby, such as lenses, mirrors and the like, become dirty in a minimum of time, as a result of which the contrast is reduced
30 and the lower scanner is often switched off.

The present invention in general aims an improved method and device for

the above-mentioned scanners while performing a coasting flight movement, for example while being rejected in a forward movement from a conveyor belt or the like or while performing a simple falling motion.

Further, the above-mentioned products are preferably also scanned as of the
5 top side and/or front side by means of at least one additional scanner. Thus is obtained that the products can be easily inspected, from the top side as well as the bottom side. When at least two scanners are moreover implemented at the bottom side which, as mentioned above, cover the entire width of the product flow, this offers the advantage that the products can be inspected over their entire perimeter, without any further scanners being necessary situated at
10 unfavourable spots, for example in the centre under the product flow. By scanning the products from three sides, it is possible to create what could be called a "full surround view", in other words all products can then be inspected over their entire or almost entire perimeter.

The products are hereby preferably scanned from at least three sides, in main directions which, seen from the direction of movement of the products, are rotated at
15 least 90° in relation to each other, and better still are mutually rotated some 120°.

It is clear that, as a function of the scan results, it is possible to carry out an automatic selection.

It is also clear that the invention also concerns devices for realising the above-mentioned methods. Consequently, it also concerns a device for the inspection of
20 products, whereby this device comprises means for conveying these products over a track in the shape of a product flow extending in the width, characterised in that it comprises at least one scanner for inspecting the products, whereby this scanner is situated at, near or along one side of the above-mentioned track. Further characteristics of this device will become clear from the following description and claims.

25 In order to better explain the characteristics of the invention, the following preferred embodiments are described as an example only without being limitative in any way, with reference to the accompanying drawings in which:

- figure 1 schematically represents a device according to the invention;
- figure 2 represents the device from figure 1 seen from a side-view;
- 30 figure 3 represents a section according to line III-III in figure 2;
- figure 4 represents a view similar to that of figure 3, but for a variant;

consist of cameras having a certain viewing angle K1-K2-K3, whereby the observed image can then be further processed. Use can also be made of a recording element or camera which instantly perceives a very restricted area, but whereby this area moves at a very high speed over the width of the product flow 5, in other words carries out a to-and-fro scan movement, for example over the above-mentioned angles K1, K2 and K3.

Further, the device 1 comprises a unit 14 for sorting the inspected products, which is controlled via a control unit 15 as a function of the observations made by the scanners 9-10-13. This unit 14, as represented, may consist for example of a series of blow nozzles 16 which can be separately controlled, directed onto the product flow 5, such that, by briefly switching on said blow nozzle 16, a product situated underneath it, indicated by 2A in this case, can be blown out of the product flow 5, for example in a waste recipient 17 or the like.

The working of the device 1 will be explained hereafter.

When the device 1 is operational, the products 2, because of the speed at which they are moved by means of the conveyor belt 6, are thrown from said conveyor belt 6 onto the inclined plane 7. They are scanned from below, on the flight, by the scanners 9 and 10, whereas they had already been previously scanned from the top by means of the scanner 13. Thus, the products 2 can be examined for the presence of certain characteristics, for example on the basis of the observed colour, the reflection of emitted rays, the shape and/or dimensions. When a product 2A is being observed having characteristics which make it undesirable, such that it has to be removed from the product flow 5, the required blow nozzle 16 will be activated in conformity with the observation made, as a result of which this product will be blown out of the product flow 5 and ends up in the waste recipient 17 or the like. It is clear that, according to a variant, also good products can be removed from the product flow 5, whereas the undesired products are being carried further, for example when the product flow 5 contains only a limited number of good products.

By using scanners 9-10 in conformity with the present invention which are erected on the side of the track 4, it is clear that these scanners 9-10 are easier to access, are less liable to pollution and easier to maintain.

By making use of viewing angles K1 and K2, as represented in figure 3, the optical path between a scanner 9 or 10 and a product 2 remains relatively restricted, which has

track 4, whereby these bending mirrors 20 are preferably also situated in the planes V4 and V5, be it at an angle in relation to these planes V4 and V5. It should be noted that these bending mirrors 20 are preferably vertically directed.

This device 1 may possibly be equipped with several adjustment facilities,
5 for example adjusting means in order to change the position and/or size of the angle over which is being scanned, in other words the viewing angles K1 and K2. The device 1 hereby preferably at least comprises adjusting means in the shape of control elements with which such a scanner 9 or 10 can be turned in the aforesaid vertical plane, for example as indicated by the arrow P in figures 5 and 6. Also, the bending mirrors 20 can be mounted such that
10 their angle is adjustable, whereby they can be rotated for example around their vertical axis. As adjusting means, use can be made of hinge suspensions and adjusting screws. Since the practical realisation thereof is known to the professional, it will not be further described here.

Further, the device 1 of figures 5 to 7 comprises several facilities to safeguard the good working order of the scanners 9-10 against disadvantageous influences, in particular against pollution. In the given example, these facilities consist of entirely closed
15 screens 21 which surround the scanners 9 and 10 concerned and any possible other elements, such as the bending mirrors 20, and which are provided with a closed light and/or radiation-transmitting window 22 via which the scanner 9 or 10 concerned can observe the products 2. Every screen 21 is embodied as a housing with a back wall 23, side walls 24, and a front wall
20 25 which is preferably at least partially removable or embodied as a door 25.

The device 1 is also equipped with cleaning devices 26, which in this case work in conjunction with the windows 22, for example in the shape of a wiper 28 which can be moved via drive element 27, either or not combined with a spray system.

It is clear that a good operation can at all times be guaranteed in this
25 manner. The screening not only makes sure that the scanners 9-10 remain dust-free, but that they can also be implemented in applications in a corrosive environment.

As a function of the application, it may also be possible to use several single screens, for example screens which only surround the scanners 9-10 on certain sides, for example at least on the sides directed towards the aforesaid track 4, and preferably also on the
30 top side, either or not combined with a window or window opening, such that the scanners 9-10 cannot be damaged by falling products. Nor is the use of other cleaning devices than those

An additional characteristic which is not unimportant either, is that means can be provided in an advantageous manner in order to create an air flow along the side of the window directed towards the product flow (i.e. the side opposite to the one directed towards the scanner). In this manner is prevented that a precipitation of dirt, moisture or dust particles coming from the product flow is formed on this side. A blowing device can for example be provided in a manner known as such, which creates a thin air flow in the shape of a curtain against said side.

from the following series:

- a screen (21) which protects the scanner (9-10) at least on its side directed towards the aforesaid track (4), and preferably also on the top side;
- a mainly closed screen (21) which surrounds the scanner (9-10) and possible other elements, such as mirrors, and which is provided with a window (22) via which the scanner (9-10) can observe the products (2);
- an entirely closed screen (21) which surrounds the scanner (9-10) and possible other elements, such as mirrors, and which is provided with a closed light and/or radiation-transmitting window (22) via which the scanner (9-10) can observe the products (2);
- a cleaning device (26);
- a cleaning device (26) which works in conjunction with a window (22) in a screen (21);
- a cleaning device (26) in the shape of a wiper (28).

8.- Device according to any of claims 1 to 7, characterised in that the means for moving the products (2) along a track (4) consist of a conveyor belt (6), which is erected such that the products (2) leave this conveyor belt (6) near its far end, and in that the above-mentioned scanner or scanners (9-10) operate in a plane (V3) immediately following this conveyor belt (6).

9.- Device according to any of claims 1 to 8, characterised in that it comprises at least one additional scanner (13) which inspects the products (2) as of the top side or front side.

10.- Device according to any of claims 1 to 9, characterised in that it comprises a unit (14) for sorting the inspected products (2), driven by means of a control unit (15) which is controlled by the above-mentioned scanner or scanners (9-10).

11.- Device according to any of claims 7 to 10, characterised in that the above-mentioned window forms an angle of 90° at the most, as of its side directed towards the product flow, with a horizontal plane extending as of the lower edge of the window.

12.- Device according to claim 11, characterised in that said angle is bigger than 70°, in particular bigger than 80°, and smaller than or equal to 90°.

13.- Device according to any of claims 11 or 12, characterised in that the window extends almost vertically.

it is used for sorting the above-mentioned products (2), whereby, as a function of the data obtained by means of the scanning, an automatic selection is carried out.

- 24.- Method according to any of the preceding claims, characterised in that the products (2) are scanned as of at least three sides, according to main directions (R1-R2-
5 R3) which are rotated at least 90° in relation to each other, and better still which are rotated about 120° in relation to each other.

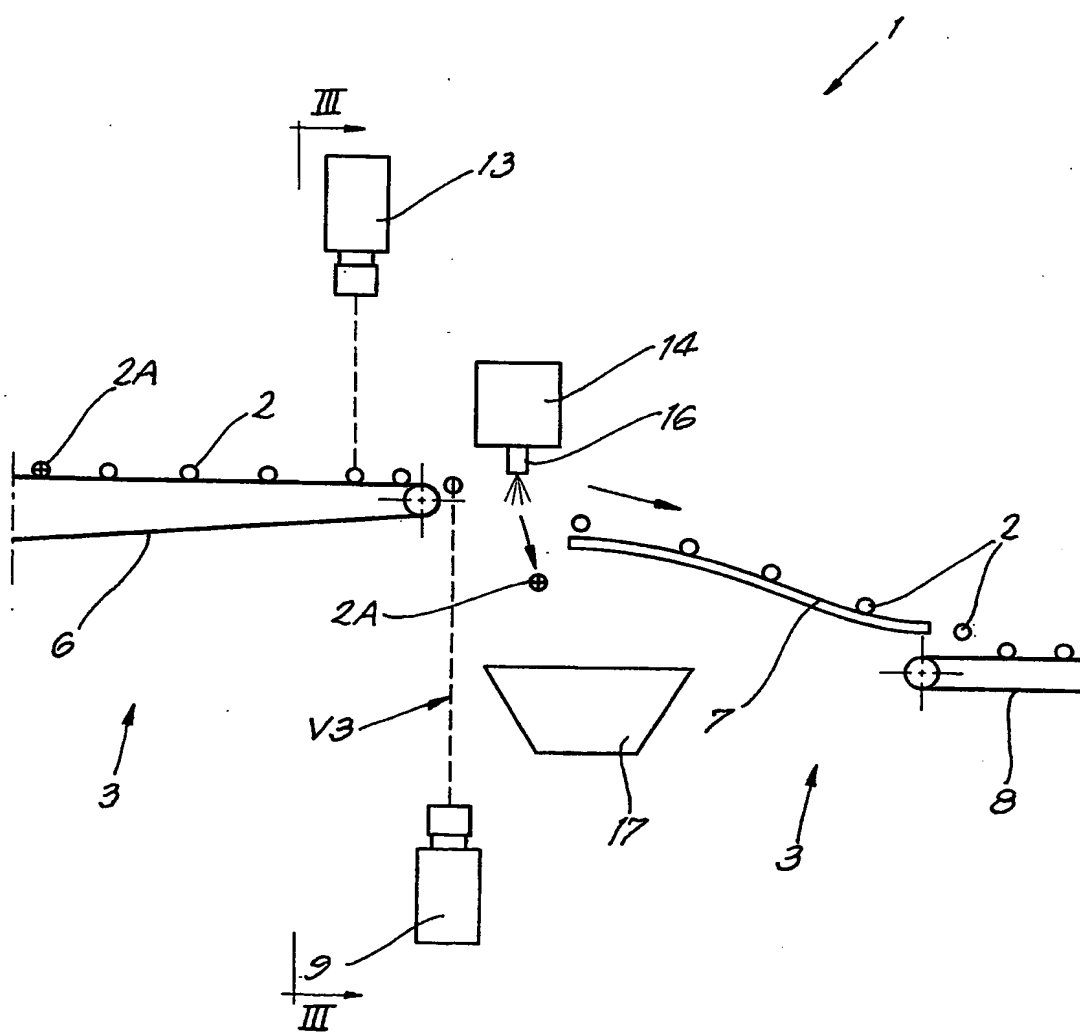
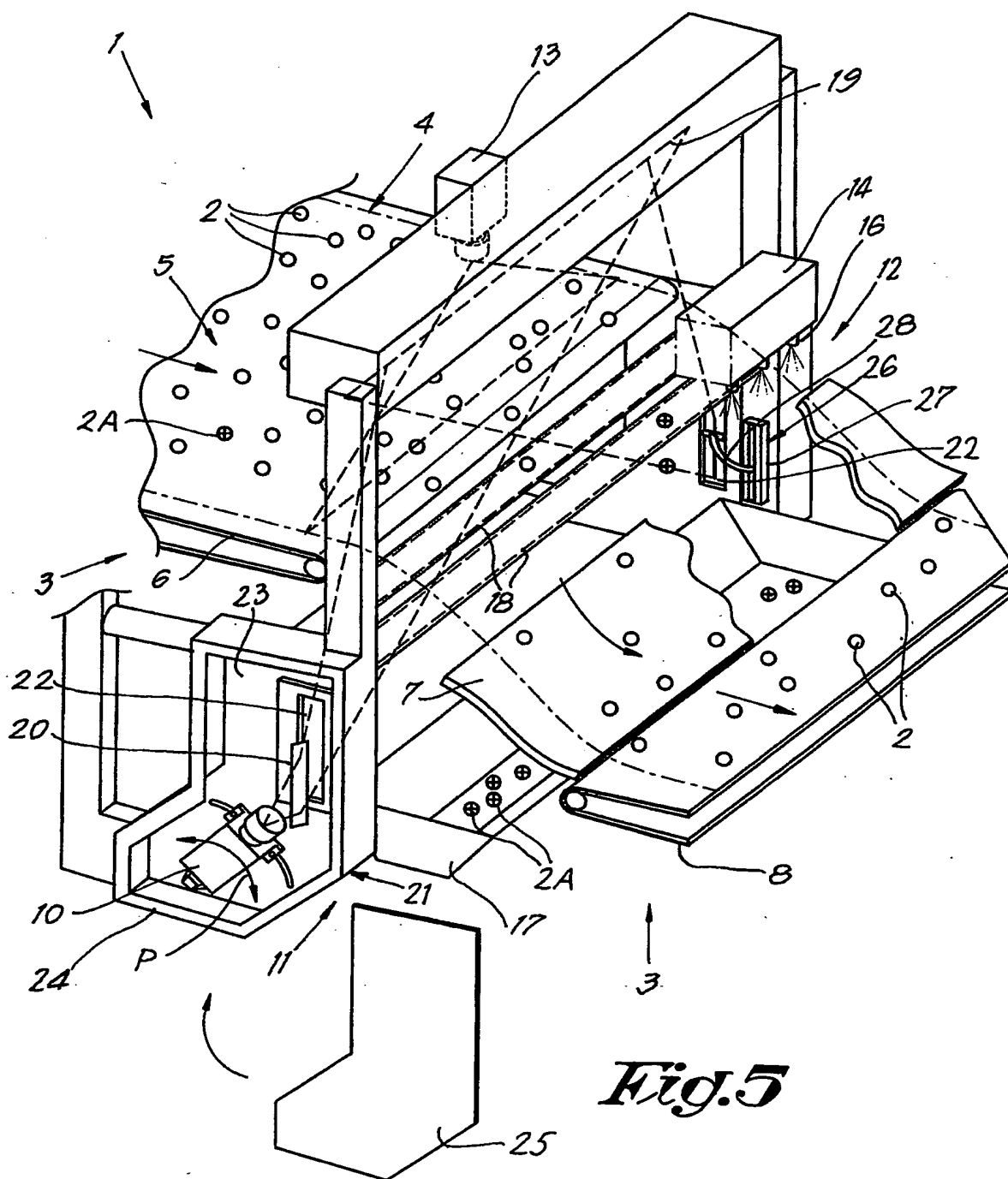


Fig. 2

**Fig. 5**